INCREASING VOCALIZATION IN CHILDREN WITH AUTISM

A Thesis in

Special Education

by

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Abstract

The Kaufman word series program is a set of techniques that involves reinforcement of successive approximation and employs phonological processes to simplify words to teach the adult form. The focus of this study was to evaluate the effectiveness of the Kaufman word series program as a method to increase intelligible words in children with autism. A multiple baseline design was used to determine which treatment implementation, Kaufman approximations, Kaufman approximations plus physical cueing, or Kaufman approximations plus finger spelling, on acquisitions of adult word forms. One condition, the Kaufman approximations plus finger spelling, developed intelligible word production in a student with autism. Using the Kaufman approximations in combination with other effective teaching practices is recommended for best outcomes. As, demonstrated by this study, further research is needed to examine the use of the Kaufman Word Shells in isolation.
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Chapter 1

Introduction

Autism is a developmental disorder classified as one of several pervasive developmental disorders (PDD) in the American Psychiatric Association, *Diagnostic and statistical Manual for Mental Disorders, Fourth Edition-Text Revision, DSM-IV-TR* (American Psychiatric Association, 2000). It is estimated that 1 in 110 children have autism. Autism is reported in all racial and ethnic groups, yet is 4 to 5 times more common in males than females (National Institute of Mental Health [NIMH], 2010). Throughout the world, it is estimated that forty-eight million people have some form of autism (Ontario Adult Autism Research and Support Network, 2010).

Autism can be present at birth, or can be observed through regressive autism, which normally begins around 18 months of age (NIMH, 2010). It is primarily diagnosed by age three and is done so through observation and an examination of the developmental history of the child. Diagnosis can be difficult because there is no physiological test for autism (e.g. blood tests or brain scans). Autism is defined by three prominent symptoms: impairments in social interactions, impairments in communication, and repetitive and stereotypical behavior. Each of these impairments leads to difficulties in both school and community functioning.

The U. S. Surgeon General states that thirty years of research on Applied Behavior Analysis (ABA) approach have shown very positive outcomes when used as an early intervention tool for autism. This research includes several landmark studies showing that about 50% of children with autism who were treated with the ABA approach before the age of four had significant increases in IQ, verbal ability, and/or
social functioning. Even those who did not show these dramatic improvements had significantly outgained matched children in the control groups. In addition, some children who received ABA therapy were eventually able to attend classes with their peers (Healing Thresholds, 2011).

Autism is a significant lifelong disability, and the goal of treatment is to promote a child’s social and language development and minimize behaviors that interfere with the child’s functioning and learning. Sundberg (2010) mentions that the primary focus of an intervention program for children with autism should be on the development of effective language skills because many children diagnosed with autism fail to develop a functional verbal repertoire. It has been reported that 50% of people who are diagnosed with autism have not developed any type of vocal speech (Rutter, 1978). Not developing a vocal repertoire is a barrier to functional communication. Spoken word is the universal language.

The purpose of the current study is to further evaluate the use of the Kaufman Word Series as a method to increase verbal communication among children with autism. The Kauffman word series program was initially developed for children with apraxia, with its value eventually discovered in the world of autism. Nancy Kaufman, a speech and language pathologist, developed this program, which assists children in attempting their best word approximations, when they cannot produce complete words, until they increase motor-speech coordination.

The Kaufman method is a set of techniques that involves reinforcement of successive approximation, and employs phonological processes to simplify words to teach successive approximations to the adult form of the word (Janeckey, McCarthy,
Sweeny-Kerwin, & Zecchin-Tirri, 2010). The program teaches the shell of words without including the complex consonants, vowels, or syllables that make a word too difficult to even attempt it on a motor basis. Kauffman (2002) states, “This teaching method is a reflection of young children attempting “first words”. With repetition, the child will be able to produce clear vocabulary and begin to combine words independently” (p. 1).

Questions addressed by this study are as follows:

(1) Does the use of the Kaufman word-shells increase intelligible word production in a student with autism?

(2) Does the use of physical cueing increase intelligible words?

(3) Does sign language increase intelligible word production.
Chapter 2

Literature Review

Autism is a complex neuro-developmental disorder that continues to be a mystery. In this chapter I will first discuss the characteristics of Autism, the diagnosis procedures, and educational treatment. Second, studies related to increasing vocalization in students with autism will be outlined.

Autism Characteristics
Autism is a developmental disorder classified as one of the several pervasive developmental disorders (PDD) in the American Psychiatric Association, *Diagnostic and statistical Manual for Mental Disorders, Fourth Edition-Text Revision*, (DSM-IV-TR). It is defined by three prominent symptoms: impairments in social interactions, impairments in communication, and repetitive and stereotypical behavior. There are no medical tests for diagnosing autism. Diagnosis must be based on observation of the individual’s communication, behavior, and developmental levels (Autism Society of America [ASA], 2010). Autism can manifest itself in two ways. Through early infantile autism, which is present at birth, or through regressive autism, which normally begins around 18 months of age (NIMH, 2010). The onset of autism continues to be one of sciences most perplexing mysteries.
Prevalence
It is estimated that 1 in 110 children have autism. Autism is reported in all racial and ethnic groups, yet it is on average 4 to 5 times more likely to occur in males than females (National Institute of Mental Health [NIMH], 2010). Prevalence rates reported by the center for Disease Control show that 2-6 per 1,000 have an ASD (National Institute of Mental Health [NIMH], 2009).

Diagnosis and Assessment
Autism is a complex disorder to diagnose and is done primarily by direct observation of the child and developmental history from the parents. Exclusionary testing is used to rule out other disorders, so that a stronger case can be made for an autism diagnosis (Behavior Analysis Association of Michigan (1997). The primary diagnostic tools for detecting autism are The Checklist for Autism in Toddlers (CHAT), Childhood Autism Rating Scale (CARS), The Parent Interview for Autism (PIA), The Autism Screening Questionnaire (ASQ), and The Australian Scale for Aspergers Syndrome. Detecting autism early is best in order to gain early intervention and support for the families.

The Checklist for Autism in Toddlers (CHAT) is a brief screening instrument that is intended to detect possible autism in children ranging from 18-36 months of age (New York State Department of Health, 2005). It provides a first level of evaluation leading to a yes/no decision that, at the current time, autism is either unlikely or is possible and then will require further evaluation. The CHAT consists of nine yes/no questions to be answered by the parents. It also includes observations of five brief interactions between the child and the examiner to which compare the child’s actual behavior with the parental reports (National Autistic Society [NAS], 2010).
The Childhood Autism Rating Scale (CARS) is used for children as young as two years of age and examines and scores a number of factors to aid in distinguishing children with autism (NAS, 2010) and the degree to which children are affected. The Childhood Autism Rating Scale was developed by staff of the Treatment and Education of Autistic and Communication-Handicapped Children Program (TEACCH) and was published in 1980 (NAS, 2010). While in development CARS used a database of over 1,500 cases to develop the comprehensive autism diagnostic tool over a 15-year period. This assessment examines fifteen categories of behavior, characteristics, and abilities against the expected development of typical children to determine whether autistic symptoms are present (NYS Department of Health, 2005).

The Parent Interview for Autism (PIA) is a structured interview containing 118 items and is arranged in eleven dimensions assessing various aspects of social behavior, communicative functioning, repetitive activities, and sensory behaviors (NAS, 2010). The PIA is a respondent-based interview that requires parents to make judgments about the frequency of occurrence of specific behaviors (NYS Department of Health, 2005). The interview is administered verbally by an examiner, so that parents can provide additional clarification as necessary. The assessment takes 30-40 minutes to complete. This assessment alone should not be the deciding factor for an autism diagnosis and is most effective when used in conjunction with direct observation.

The Autism Screening Questionnaire (ASQ), also called the Social Communication Questionnaire (SCQ), is a reliable and valid screening instrument based on the current diagnostic criteria for autism in the DSM-IV. This screening was developed by Rutter and Lord and is to be used with all age groups. The ASQ is to be
completed by primary caregivers on individuals who might have autism spectrum disorder (NAS, 2010). It is available in two versions: one for children under six years of age and the other for children six years and above.

The Australian Scale for Aspergers Syndrome is a parent or teacher rating scale for high-functioning older children on the autism spectrum who have not been identified with an autistic spectrum disorder by school age (NAS, 2010). This assessment consists of twenty-four questions scored from one to six plus a checklist of ten additional yes/no behavioral characteristics related items.

A full evaluation can take from several hours to a few days. After information is collected from the child, parents, pediatrician, and an observation made by a professional, a multidisciplinary team meets to discuss if further investigations is needed or if a diagnosis can be made based on current information. If a diagnosis is made, counseling will be provided to parents and intervention should immediately begin for the child.

Social Impairments
As infants, children with autism may have a tremendous difficulty learning to engage in the give-and-take of everyday human interactions. They also often exhibit less attention to social stimuli like smiling and making eye contact with people or responding to their name. As toddlers, children with autism may exhibit more severe forms of social impairment in terms of anticipatory postures as well as not attend to social understanding emotional expression and spontaneity as compared to neurotypical toddlers. They may resist attention or passively accept hugs or cuddling (Autism Speaks, 2010).

Individuals with autism demonstrate several characteristics that affect social interaction skills. The use of sarcasm in conversations exemplifies the importance of
being able to interpret tone of voice, facial expression and body language. People with autism struggle with the use of multiple nonverbal behaviors such as eye contact, facial expression, body postures, and gestures (DSM-IV, 1994).

The developments of peer relationships are difficult because children with autism may not find peer interactions intrinsically motivating. Many individuals tend to initially view significant adults in their life as a means to meet their needs and fulfill their requests, instead of peers being the object of interest.

Communication Impairments

The majority of individuals with autism do not develop natural speech in order to functionally communicate in their environment (Autism Speaks, 2010). Communication problems of individuals with autism vary and can include both verbal and non-verbal language. Some may be unable to speak, whereas other may have rich vocabularies. Many children diagnosed with autism and other developmental disabilities fail to develop a functional verbal repertoire. It has been reported that 50% of people who are diagnosed with autism have not developed any type of vocal speech (Rutter, 1978). Vocal language such as voice quality, speaking style, rhythm, intonation, rate, and pitch may be distorted. Individuals with autism also struggle with understanding pragmatics, semantics, morphologies, and syntaxes, making it very difficult to convey language effectively (Rutter, 1978).

Many individuals with autism are further diagnosed with a specific communication disorder such as apraxia or echolalia. Verbal Apraxia is a neurological disorder characterized by the loss of the ability to coordinate mouth and speech movements, despite having the desire and the physical ability to perform them (National
Institute of Neurological Disorders and Stoke [NINDS], 2010). Echolalia occurs when a child repeats verbal information stated by others. It can include repetition of part of the utterance, as well as an identical repetition of the entire spoken utterance, sometimes including an exact replication of the inflectional pattern used by the speaker. Echolalia can be a repetition of something they just heard and a repetition of information heard previously (NINDS, 2010). For example, if you ask a child, “Do you want a cookie?” The child may say, “Do you want a cookie?”

Repetitive and Stereotypical Behaviors

Individuals with autism develop rituals or routines for organization and to make sense of the world around them. Many individuals with autism form obsessions with their favorite items or objects. For example, a child may become obsessed with a particular book or character from a movie. These obsessions or restricted interests limit their ability to explore new or unfamiliar things (Lilienthal, 2008).

Individuals with autism may display unusual movements such as rocking, hand flapping, jumping, etc. They frequently experience difficulties when changes are made to their routine or rituals and are unable or unwilling to be flexible in adhering to changes (Lilienthal, 2008).

Intervention

Educating children with autism is a challenge for both parents and teachers. These children are individuals with unique strengths and weaknesses. Some children may have average to above-average intelligence, while others may be below average (ASA, 2010). Education for children with autism may look completely different for one student than it will for another. All children have strengths and weaknesses and should
be educated using the best scientific practices to help them lead a functional and socially appropriate life.

Autism is a significant lifelong disability, and the goal of treatment is to promote the child’s social and language development and minimize behaviors that interfere with the child’s functioning and learning. According to the United States Surgeons General (2001) research demonstrates the efficacy of applied behavioral methods in reducing inappropriate behavior and in increasing communication, learning, and appropriate social behavior.

The ability of adults with autism to take care of themselves is often directly related to the need-based education they receive as children. If properly taught social responses and accepted behaviors, adults with autism can function as contributing members of society. They can have families, careers, and social lives. However, the majority of adults with autism live at home with their parents or in a residential facility (Disability Resource Directory, 2011).

The potential of young adults and adults with autism to become employed and engaged citizens of the United States is not so much limited by their disability itself, but rather, by the failures of the system charged with supporting them. The Center for Autism and Related Disabilities (CARD), conducted a study in Florida in 2008 in order to examine some of these issues. The study surveyed 200 families with adult children with autism. They found that approximately 73% indicated they needed help with their job; 63% needed help with daily living; 74% wanted to work, and only 19% were working. The economic cost of this system’s failure is far reaching. These costs can be expected to grow exponentially without a better and more comprehensive understanding
of the needs of adults with autism and plans for productive and effective solution (Advancing Futures for Adults with Autism, 2011).

Applied Behavior Analysis

B. F. Skinner was the founder of experimental analysis of behavior and began his work with the publication of *The Behavior of Organisms* in 1937. This book describes two kinds of behavior, respondent and operant behavior. Respondent behavior is elicited by stimuli that immediately precede them. These behaviors are involuntary and occur whenever the stimulus is presented. Operant behaviors are not elicited by preceding stimuli, but instead are influenced by stimulus changes that have followed the behavior in the past (Cooper, Heron, & Heward, 2007, p. 10). Skinner focused on operant conditioning and the effects of consequences on behavior in our environment.

Skinner describes behaviorism as the philosophy of the science of behavior (Skinner, 1974). Behaviorism is the theory of learning that demonstrates that behaviors are acquired through conditioning. This occurs through interaction with our environment and can be studied in a systematic and observable manner. This branch of behavior analysis would later be known as Applied Behavior Analysis (ABA) (Cooper, Heron, & Heward, 2007, p. 14)

Applied Behavior Analysis is the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change (Cooper, Heron, & Heward, 2007, p. 20). To further highlight these ideas Baer, Wolf, and Risley wrote an influential paper entitled “*Some Current Dimensions of Applied Behavior Analysis.*” This paper recommended that applied behavior analysis should be
applied, behavioral, analytic, technological, conceptually systematic, and capable of appropriately generalized outcomes (Cooper, Heron, & Heward, 2007, p. 16). This paper has become the seven key dimensions recommended for defining ABA and include (1) investigates socially significant behaviors with immediate importance to subjects; (2) the behavior targeted for change must be defined, measurable, and observable; (3) demonstrates experimental control over the occurrence and nonoccurrence of the behavior, demonstrates a functional analysis; (4) the details of the study must be identified to permit study replication; (5) the behavior change interventions must be derived from the basic principles of behavior; (6) behavior change interventions produce strong, socially important effects; (7) produces behavior changes that appears in other environment and is durable over time (Cooper, Heron, & Heward, 2007).

These dimensions describe the fundamental characteristics of any good applied intervention. They can also be used to guide formative analyses of applied behavioral treatments. Bear, Wolf, and Risley state, “treatments that do not feature all seven dimensions are incomplete and potentially compromised in effectiveness” (p. 91).

The seven dimensions of behaviors defined the criteria for judging the adequacy of research and practice in applied behavior analysis. Even though the article was written over 40 years ago, the seven dimensions continue to serve as the primary criteria for defining and judging the value of ABA (Cooper, Heron, & Heward, 2007).

**Verbal Behavior**

Wide varieties of theories of language attempt to identify the causes of language and are classified into three categories: biological, cognitive, and environmental. Biological theory language is a function of physiological processes and functions. The
cognitive approach to language proposes that language is controlled by internal processing systems that accept, classify, code, encode, and store verbal information (Cooper, Heron, & Heward, 2007). Environmental theory, according to Skinner (1957), is that language is a learned behavior, and that it is acquired, extended, and maintained by the same types of environmental variables and principles that control non-language behaviors. He defined verbal behavior as behavior that is reinforced through the mediation of another person’s behavior (Cooper, Heron, & Heward, 2007).

Verbal behavior makes a clear distinction between the behavior of the speaker and that of the listener. The speaker gains access to reinforcement and controls their environment through the behavior of listeners. Skinner was mostly concerned with the behavior of the speaker.

Skinner (1957) used the term “verbal behavior” in his book *Verbal Behavior*, because he wanted a term that emphasized the individual speaker. He referred to the behavior that was selected and maintained by consequences. This term was unfamiliar in the professions of speech and language (Cooper, Heron, & Heward, 2007). The term verbal behavior can be confused with vocal communication, implying that the person has to speak in order to be displaying verbal behavior. Verbal behavior includes both vocal-verbal behavior and nonvocal-verbal behavior.

Vocal-verbal behavior takes place when a child says something to another person and that other person mediates the child’s verbal behavior. For example, vocal-verbal behavior occurs when a child says to a teacher, “I want that pencil” and the teacher hands the child a pencil. The child could have also signed pencil, written pencil, or typed pencil. Conversely, non-verbal behavior would be the child going over and picking up
the pencil. The act of going to pick up the pencil is non-verbal behavior because direct access to reinforcing consequences does not depend upon another person. Verbal behavior allows the speaker to gain access to reinforcement through the behavior of the listener, which enables the speaker to control his/her environment.

Skinner (1957) identified elementary verbal operants that consist of mands, tacts, echoics, intraverbals, textuals, and transcription. Each operant is a unit of language that functions in relation to environmental variables. A mand is a requesting behavior used to obtain objects or information. It is evoked by the antecedent stimulus of “wanting” something and the direct consequence of the mand is obtaining the item. Manding occurs when the motivation for something is strong and are often the first verbal operant acquired since they are usually paired with the delivery of reinforcement. The mand is the only verbal operant that is directly reinforced by the object. For example, a child sees a cookie and says “cookie.”

Contacting something in the immediate environment, such as, a specific object, event, property of an object or event, evokes the tact. For example, when a student sees a tree they say “tree.” The tact is evoked by some sensory stimuli and the consequence is non-specific reinforcement. Tacts are strengthened by social reinforcement and benefit the listener, whereas mands benefit the speaker. An intraverbal is a word sequence, word association, answering a question, or fill-in where the verbal stimulus and the response have no point-to-point correspondence. It is evoked by some verbal stimuli in the environment and non-specifically reinforced. Intraverbals are taking turns in communication where your words are controlled by another person’s words. For example, when an adult says “Dora the_____.” The child will say “explorer.”
Textual behavior is reading without having to understand what is being read. Textual behavior has one-to-one correspondence, but not formal similarity, between the stimulus and the response product (Cooper, Heron, & Heward, 2007). Conversely, transcription consists of writing and spelling words that are spoken (Cooper, Heron, & Heward, 2007).

The echoic operant is a type of verbal operant that occurs when a speaker repeats the verbal behavior of another speaker (Cooper, Heron, & Heward, 2007). The verbal stimulus is auditory and the response is speaking which has point-to-point correspondence. One of the most important skills in the development of a vocal verbal repertoire is a child’s ability to vocally imitate sounds or words (echoic behavior). Echoic behavior is defined as a verbal operant with point to point correspondence between the sound of the stimulus and the sound of the response (Skinner, 1957).

Skinner (1957) states that, in formal education, the echoic repertoire allows the teacher to bring echoic responses under new forms of stimulus control. For example, teaching young children to name things is easier for the teacher after an echoic repertoire has already been established. Furthermore, it has been suggested that an established echoic repertoire can aide in the development of other language repertoires (Carbone, 2010). For example, an instructor might pair a preferred reinforcer with an early developing sound that corresponds with the item. Due to the paucity of research the most effective teaching sequence is still unknown at this point.

Although the importance of the echoic repertoire has been well established, it remains perhaps one of the most difficult repertoires to teach in children who fail to acquire it through typical means (Carbone, 2010). Drash, High, and Tudor (1999) report,
“One of the most challenging tasks in establishing functional verbal repertoires in autistic and other language delayed children is teaching vocal imitation to children who have no speech and no ability to imitate (p. 8).”

Table 1. Verbal Operants.

<table>
<thead>
<tr>
<th>Operant</th>
<th>Brief Definition</th>
<th>Example</th>
<th>Sample Discriminative Stimulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mand</td>
<td>Asking for something you are motivated for (student gets reinforced with what they asked for)</td>
<td>Student says “cookie” because they want one (teacher gives cookie)</td>
<td>MOTIVATION is the antecedent for the mand!!!</td>
</tr>
<tr>
<td>Tact</td>
<td>Student labels something they see, hear, smell, taste, or feel and gets non-specific reinforcement (such as praise or other reinforcer)</td>
<td>Student says “cookie” because they see a picture of a cookie.</td>
<td>What is this? \nThis is a ______ \nIt’s a _______ \nTell me what this is \nWhat do you see?</td>
</tr>
<tr>
<td>Listener Responding (Receptive)</td>
<td>Following directions and or receptive identification (discrimination). Reinforcement is non-specific.</td>
<td>Student touches the cookie when teacher asks “do you see a cookie?”</td>
<td>Point to the ____ \nShow me the ____ \nCan you find the ____ \nWhere’s the ____?</td>
</tr>
<tr>
<td>Motor Imitation (Mimetic)</td>
<td>Copying someone else’s motor movement. Reinforcement is non-specific</td>
<td>Student signs “cookie” when teacher signs “cookie”</td>
<td>“Do This” \n“Can you do this”? \n“Try this one” \n‘Do what I do’</td>
</tr>
<tr>
<td>Echoic</td>
<td>Repeating (vocally) what someone else says. Reinforcement is non-specific</td>
<td>Student says “cookie” because teacher said “cookie”</td>
<td>Which one do you ____ with? \nYou ____ with a ____ \nSomething you ____ is a ____ \nTell me the one that has ____ \nThe (animal) says ____</td>
</tr>
<tr>
<td>Intraverbal</td>
<td>Saying, signing, writing something related to what someone else said or answering questions (fill-in responses, word associations, conversation). Reinforcement is non-specific</td>
<td>Student says “cookie” when teacher says “tell me something sweet that you eat”.</td>
<td></td>
</tr>
</tbody>
</table>
Verbal Behavior uses procedures derived from the discipline of ABA (e.g., shaping), which have been shown to be highly effective in teaching children with autism. It provides empirically based evidence indicating that procedures developed using ABA based principles are effective at assessing and treating a variety of socially important behaviors (Hagopian & Boelter, 2010).

Augmentative and Alternative Communication

Augmentative and Alternative Communication (AAC), is an area of clinical practice that attempts to compensate (either temporarily or permanently) for the impairment and disability patterns of individuals with severe expressive communication disorders (American Speech-Language-Hearing Association [ASHA], 2010). Augmentative and Alternative Communication is used by people who cannot rely on their speech to communicate. Forms of AAC are divided into two categories, which are known as unaided and aided (ASHA, 2010).

Unaided forms of communication consist of nonverbal means of natural communication including gestures, facial expressions, as well as manual signs and American Sign Language (ASL). Aided forms of communication consist of those approaches that require some additional external support, such as a communication board with visual-graphic symbols (pictures, photographs, line drawings, printed word) that represent what an individual wants to express. It can also be a sophisticated computer with symbols, words, letters, or icons that “speaks” for its user via either synthetically produced speech or recorded natural speech (ASHA, 2010).
Picture Exchange System

Picture Exchange System (PECS) is an unaided form of augmentative communication that uses pictures instead of words to help children with communication. It is behaviorally based and designed for children with social-communicative deficits (Flippin, Reszka, & Watson, 2010). As Bondy and Frost (1994, p.3) described, “Children using PECS are taught to approach and give a picture of a desired item to a communicative partner in exchange for that item. By doing so, the child initiates a communicative act for a concrete item within a social context” (Flippin, Reszka, & Watson, 2010).

Sign Language

Sign Language is an unaided form of augmentative communication. It is a complete, complex language that employs signs made with the hands and other movements, including facial expressions and postures of the body (National Institute on Deafness and Other Communication Disorders [NIDCD], 2010). Sign language is also taught to other children with disabilities, including those with autism, to produce functional communication.

Kaufman Word Series

The Kauffman word series program was initially developed for children with apraxia, with its value eventually discovered in the world of autism. Nancy Kaufman, a speech and language pathologist, developed this program. It assists children in attempting their best word approximations, when they cannot produce complete words, until they increase motor-speech coordination. The Kaufman method is a set of techniques that involves reinforcement of successive approximation, and employs
phonological processes to simplify words to teach successive approximations to the adult form of the word (Janeckey, McCarthy, Sweeny-Kerwin, & Zecchin-Tirri, 2010). The program teaches the shell of words without including the complex consonants, vowels, or syllables that make a word too difficult to even attempt it on a motor basis. For example, the adult form word is da-da and the Kauffman shell is dah. Kauffman (2002) states, “This teaching method is a reflection of young children attempting “first words”. With repetition, the child will be able to produce clear vocabulary and begin to combine words independently” (p. 1).

There is an overwhelming amount of evidence to support that new behaviors can be established by breaking a task down into smaller units and shaping them toward the target behavior using reinforcement techniques (Skinner, 1974). Utilizing these well-known techniques of operant conditioning, consonants and vowels can be shaped into best approximations of words to become functional vocabulary until the child is able to master the adult form of the word (Kaufman, 2010).

Increasing Vocalizations for Students with Autism Research

A review was conducted that focused on the experimental research that evaluated different methods used to increase vocalizations for students with autism. A variety of systems were reviewed to determine the most beneficial method to increase vocalizations in students with autism. Picture exchange communication systems, assistive technology, sign language, and the Kauffman Apraxia Word Series are the four systems that are primarily used to increase vocalizations for children with autism.

The four studies selected for review sought to evaluate the procedures used to increase vocalizations in children with autism and determine the validity of the functional
relation using the four different methods. Table 1 summarizes details of the studies and treatment approaches. All participants across these studies were children with autism.

Vincent Carbone and colleges measured the acquisition of tacts for pictured objects comparing total communication (sign plus vocals) and the vocal alone condition. Total communication is the most commonly used training procedure to teach sign language to children with autism and other developmental disabilities. It involves the simultaneous presentation of both manual sign and an associated spoken word (Carbon, Dixon, Louden, Guinn, & Sweeney-Kerwin, 2006).

The participant was a seven-year-old female with autism in the moderate range of disability. She demonstrated an echoic repertoire and had acquired a variety of vocal mands that were controlled by both the presence of a desired item and motivating operation. The participant’s tact repertoire was limited and prior to the implementation of the independent variables in the study, she has acquired 57 vocal tacts over an eight month period.

During the vocal-alone (VA) training condition, vocal tacts were taught using only a vocal prompt to evoke responses during teaching trials. During each trial, the teacher modeled the correct response immediately following the initial display of the picture paired with the question “what is it?” Following the modeled response, the teacher displayed the picture again and said “what is it?” and paused three seconds in order to wait for a response. Correct responses were reinforced by verbal praise.

During the total communication (TC) condition, vocal tacts were taught using a vocal prompt plus display of the manual sign by the teacher, to evoke correct responses. The same procedures were used in this condition as in the vocal-alone condition.
The participant received a total of about 7,500 trials in the VA condition and about 6,500 trials in the TC condition. The first tact in the TC condition was mastered by the fifth treatment session and after 89 teaching trails. By the end of 28 treatment sessions, the participant had mastered 30 tacts in the TC condition. The first tact in the VA condition was not mastered until the seventh treatment session and after 148 teaching trails. Only eight tacts were mastered by the end of 28 treatment sessions.

The results indicate that, for the child with autism in the study, that the total communication procedure was superior to the vocal-alone procedure to support the acquisition of tact responses. The participant acquired almost four times the number of responses following total communication training and mastery was achieved in this condition following significantly fewer teaching trials. These results support the fact that the addition of manual sign language to vocal training programs may increase vocal responding in learners for whom vocal-alone training has not produces satisfactory outcome (Carbon, Lewis, Sweeney-Kerwin, Dixon, Louden, & Quinn, 2006).

The second study conducted by Barrera, Barrera, and Sulzer-Azaroff (1980) was conducted in order to simultaneously compare the relative effectiveness of three different language training models (total communication, nonverbal “sign-alone” training, and oral (vocal) training) for teaching expressive language skills. A single-subject, alternative-treatment design with replication within subject was used to compare the rate of expressive word acquisition across training models.

The subject was a four and a half year-old boy who attended a special education preschool program. Prior to the study the participant received only minimal formal language training. The study was conducted in four phases. Phase I allowed for an
adaptation period during which the child adjusted to the treatment environment and reinforcers were sampled and selected. Phase II focused on the training of two prerequisite attending behaviors (sitting and eye contact).

During phase III the actual training model comparison was conducted, with the child receiving 20 minutes of direct language training with each model every day. Training with all three models continued until the participant’s responding met a preset criterion for acquisition (15 consecutive correct responses intermixed with responding on at least two other words) on all five words within one of the categories. Mean percentages of correct responses for the first group of words, for this phase, were as follows: total communication – 59%, oral – 17%, sign-alone – 37%. In the second group of words the trend was duplicated: total communication – 51%, oral – 12%, and sign-alone – 20%.

Phase IV of the study, consisted of a period of intensive training (60 minutes per day for 3 consecutive days), using only the training model that promoted best performance during comparison tests, which was total communication. While the percentage of combined-form responding dropped slightly during the three days of Phase IV (23%, 19%, and 23%), it was noted that this percentage remained fairly high in light of the fact that thirteen new words were introduced.

A generalization phase was conducted at the end of the procedure with the introduction of a new therapist and the removal of the original training stimulus. The participant responded correctly to 100% of the words learned in the total communication category. This study shows that total communication was by far the most efficient method for teaching vocalization, and the data also suggests that the use of physical
prompts provided the basis for the demonstrated success. (Barrera, Barrera, & Sulzer-Azaroff, 1980).

The next study conducted by Matt Tincani compared the effects of PECS and sign language training on the acquisition of mands and also examined the differential effects of each modality on students’ acquisition of vocal behavior. The participants were two school-aged children with autism enrolled in a self-contained classroom for children with multiple disabilities. The participants were selected for the study because of their difficulties with functional speech. They each used gesturing as his or her primary means of communication.

The study was an alternating treatments design with an initial baseline phase and final “best-treatment” phase to compare the effects of sign language and picture exchange training. Sign language training involved two people; the experimenter, who sat in front of the participant and acted as the listener, and a second trainer, who delivered prompts while seated behind the participant. Each session started by finding out if the item was motivating. If the experimenter presented the item, then signed and vocalized the name of the item. If the participant did not correctly sign the name of the item following physical and vocal models from the experimenter, the second trainer physically prompted the participant from behind. Sign language training with a selected item continued for five to seven trials, or until the participant was satiated.

Training for PECS was conducted in the same manner as in the sign language training condition. The only difference was that the experimenter presented the item and did not give a modeled prompt or cue for the participant. The second trainer seated
behind the participant, provided physical assistance to pick up and exchange a picture to request the item.

The results indicate that Participant One emitted more independent mands during sign language than PECS. Independent mands during sign language were 46.4% compared to 7.6% during PECS training. Participant One did not have any word vocalizations during baseline, but emitted on average 46.3% word vocalizations in sign language training and emitted an average of 22.3% percent during PECS training.

Participant Two emitted more than three times as many independent mands in PECS training than in sign language training. Word vocalizations seemed to be opposite, with the participant emitting 93.4% vocalizations during sign language training and 77.9% during PECS training.

In contrast to the mixed results for mand acquisition, sign language training produced more vocalizations for both participants (Tincani, 2004).

The final study examined the speech production of children with autism by comparing the adaptation of the procedures recommended within the Kaufman method that include assessment, selection of targets and shaping through reinforcement of successive approximations toward the target word. The Kaufman approach was compared to an echoic procedure that included reinforcement for correctly echoing the target response and extinction for echoing incorrect responses.

Two participants included in the study were a three year old boy diagnosed with autism and moderate disabilities with a developing language repertoire and a four year old boy also diagnosed with autism. Both participants had hearing within the normal range and did not present any oral-motor problems which would preclude them from
producing speech sounds. Each learner’s articulation was evaluated using the Kaufman Speech Praxis Treatment Assessment – Basic Level. Using this assessment, word categories where articulation broke down were identified. Individual words from the categories were selected as targets for the intervention. The words were then randomly assigned to one of the two experimental conditions, Kaufman or Echoic.

Treatment on a group of words were discontinued after all words in either group met criteria. Participant One met criteria on all words which received the Kaufman protocol, so a second and third group was placed into treatment. The dependent variable was defined as the number of correctly articulated words that met the mastery criteria of three consecutive daily cold probes. A correct response was defined as the learner correctly echoing the adult form of the word presented by the instructor within three seconds of the presentation of the echoic stimulus.

An alternating treatment design across words was used to evaluate the training procedures. Each treatment session began with a cold probe for each word by presenting the adult form. In the echoic session the instructor presented an echoic stimulus of the target word. If parity occurred (i.e., student gave correct answer), a reinforcer was delivered. If parity did not occur, the echoic stimulus was presented five times. The instructor waited 0-2 seconds for a response. Two teaching trails for each word occurred during a session.

In the Kaufman protocol each targeted word was broken down into word shells in a hierarchy from simple to complex. The instructor presented the lowest word shell as an echoic stimulus. If parity occurred, the instructor would immediately move up to the next word shell and present that shell as an echoic stimulus. If parity continued, the instructor
would continue to move up the shell until the adult form was echoed. If parity did not occur, the instructor would present that word shell as an echoic stimulus five more times.

Participant One met criteria on all fourteen words that underwent treatment using the Kaufman protocol and only met criteria on six of the words that underwent treatment using the echoic protocol. Participant Two met criteria on all four words that underwent treatment using the Kaufman protocol and only met criteria on one of the words that underwent treatment using the echoic protocol. The results of the study demonstrated that using the Kaufman protocol is superior to the echoic protocol, with these participants, related to the improvement of articulation (Sweeney-Kerwin, Zecchin-Tirri, Carbone, Janeckey, Murray, & McCarthy, 2010).

Sundburg (2010) suggested that the primary focus of an intervention program for children with autism should be on the development of effective language skills. The current literature has a vast array of theories and opinions, but lacks studies that show empirical evidence that a program really works. The purpose of the current study is to use these prior works on increasing vocal production and merge it with the Kaufman Word Series program to show if it can produce intelligible words for a student with autism.
### Table 2: Summary of Literature

<table>
<thead>
<tr>
<th>References</th>
<th>Participants</th>
<th>Setting</th>
<th>Experimental Design</th>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Duration</th>
<th>Generalization measures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbone, Dixon, Kerwin, Lounsd, Quinn, Sweeney-Kerwin, 2006</td>
<td>7 years old, Female, Autism</td>
<td>Home</td>
<td>Alternating treatment</td>
<td>(1) Vocal prompt to evoke responses during teaching</td>
<td>Acquisition of tacts for pictured objects</td>
<td>28 treatment session</td>
<td>Not mentioned</td>
<td>(1) 8 tacts, (2) 30 tacts</td>
</tr>
<tr>
<td>Barrera, Barrera, &amp; Salzer-Azaroff, 1980</td>
<td>4 year old boy</td>
<td>Preschool</td>
<td>Alternating treatment</td>
<td>(1) total communication</td>
<td>Rate of expressive word acquisition across training models</td>
<td>Not mentioned</td>
<td>(1) 100% responding with new therapist and removal of original training stimulus</td>
<td>(1) 10 words, (2) 4 words, (3) 4 words</td>
</tr>
<tr>
<td>Tinanti, 2004</td>
<td>5 year old (1) male, Autism &amp; MR</td>
<td>Public School</td>
<td>Alternating treatment</td>
<td>(1) Sign Language (2) PECS training</td>
<td>Motor Imitation Mands, Word vocalization</td>
<td>22 communication opportunities during each sign and PECS phase</td>
<td>(1) 0% PECS and 34% signs, (2) 94% PECS and 66% signs</td>
<td>Motor Imitation: (1) 43% correct Mands: (1) 2.1% in sign language; 17.9% in sign language and 59.6% in (2) 12.9%</td>
</tr>
<tr>
<td>Carbone, Janeckey, McCarthy, Murray, Sweeney-Kerwin, &amp; Zecchin-Tirri, 2010</td>
<td>4 year old (2) male, autism</td>
<td>Private School</td>
<td>Alternating treatment</td>
<td>(1) Kaufman word shells</td>
<td>Number of correctly articulated words that met mastery criteria of three consecutive daily cold probes</td>
<td>14 weeks</td>
<td>Not mentioned</td>
<td>(1): Kaufman word shells: 4 words Echoic: 1 word, (2): Kaufman word shells: 14 words Echoic: 6 words</td>
</tr>
</tbody>
</table>
Chapter 3

Methods

Training
Training of the teaching procedures for each condition was conducted for three staff members: the teacher, speech therapist and one paraprofessional. The teacher was to be a replacement in the event that the speech therapist could not complete the study or was absent. The paraprofessional was trained on how to complete inter-observer agreement (IOA) and fidelity check procedures.

Training for the Kaufman procedures was completed by the speech therapist and teacher at a Kaufman seminar, one year prior to conducting the study. The experimenter then trained all staff using a model approach (I do, we do, you do).

Participants
The participant’s parents completed and returned the consent form for Social Science Research obtained through the Pennsylvania State University Institutional Review Board. The participant was a fifteen year-old female who has a primary diagnosis of Autism and a secondary diagnosis of severe Mental Retardation. The participant had periventricular leukomalacia at birth and a history of seizures. After completion of the Verbal Behavior Milestones Assessment Placement Program (VB MAPP) (Sunberg, 2008) the participant scored in the early to intermediate level. This score implied that the student was non-hearing impaired, but had severe language deficits. The participant’s mode of communication was finger spelling, some sign, typing, gestures, and vocalizations.
Setting

All of the teaching sessions were conducted in the participant’s classroom. The teaching sessions were all conducted in the same designated area to reduce the effects that may occur from changing locations. The participant and the teacher were in a small corner of the room so they would not be distraction to other students. The participant was seated across from the instructor at a table. All instructional materials and reinforcers were prepared prior to each session.

Reinforcer Selection

In order to ensure high motivation to comply with demands during the study, reinforcers were selected prior to the start of the training session. A preference assessment was used to gather a list of preferred items from categories of edibles, activities, and tangibles. The most preferred reinforcers were to be used only during the study session in order to reduce satiation during the course of the study.

Experimental Design and Analysis

A multiple baseline design across words was used to display baseline and treatment phases. Baseline was determined by attaining stability of five data points at zero for each target word. Subsequent targets were held at baseline until criteria for treatment introduction was reached.
Procedures

Target Selection and Presentation

Targets were presented five times during one, 10-minute, session. Previously acquired echoic targets (“easies”) were presented between targets to reduce problem behavior. The easy to hard ratio during treatment was 20% hard demands to 80% easy.

Baseline and Treatment Implementation

Baseline was established with stability: five data points at zero for each target word. Subsequent targets were held at baseline until criteria for treatment introduction was reached. When the first word reached stability (five data points at zero), treatment began. The second and third word remained at baseline until the participant acquired parity of the adult word form for three consecutive days on the cold probe, and then the second word was introduced. The same procedures were repeated for Word Three.

Intervention Phase I

In this condition, the speech therapist presented the first trial at the probed level for that day. If the participant was correct, the speech therapist moved to the next shell. If the participant did not imitate correctly on the probed shell, she presented the shell 2-3 more times. If the participant responded incorrectly on the two-three repetitions, the speech therapist modeled the first shell that was originally used or the highest-level word shell that was imitated accurately. If the participant reached parity for the adult form of the word, the speech therapist showed the participant the picture and delivered the reinforcer.
Sample of word reaching parity:

<table>
<thead>
<tr>
<th>Trail</th>
<th>Teacher</th>
<th>Learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probed Shell</td>
<td>“Say dah”</td>
<td>“dah”</td>
</tr>
<tr>
<td>Next Shell</td>
<td>“Say da”</td>
<td>“da”</td>
</tr>
<tr>
<td>Next Shell</td>
<td>“Say dah-dah”</td>
<td>“dah-dah”</td>
</tr>
<tr>
<td>Adult Form</td>
<td>“say da-da”</td>
<td>“da-da”</td>
</tr>
</tbody>
</table>

Sample of incorrectly imitating word:

<table>
<thead>
<tr>
<th>Trail</th>
<th>Teacher</th>
<th>Learner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probed Level</td>
<td>“Say dah”</td>
<td>“dah”</td>
</tr>
<tr>
<td>Next Shell</td>
<td>“Say da”</td>
<td>“de”</td>
</tr>
<tr>
<td>Error</td>
<td>“say da”</td>
<td>“de”</td>
</tr>
<tr>
<td>Error</td>
<td>“Say da”</td>
<td>“de”</td>
</tr>
<tr>
<td>Error</td>
<td>“say da”</td>
<td>“de”</td>
</tr>
<tr>
<td>Original Probe</td>
<td>Say dah”</td>
<td>“dah”</td>
</tr>
</tbody>
</table>

**Intervention Phase II**

The Second Intervention was only put in place if all three words did not meet parity of the adult form. The second intervention was implemented in the same way as the first except for when an error occurred. If an error occurred, the appropriate physical cue was used, from the cueing picture list, for the specific sound. If the participant was correct on the cued trial, the speech therapist ran an un-cued transfer trial. If the
participant was incorrect on the cued trial, the speech therapist ran three repetitions of the cued trial and then dropped back to the lower word shell.

Sample: One error

<table>
<thead>
<tr>
<th>Trial</th>
<th>Teacher</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe</td>
<td>“say buh”</td>
<td>“buh”</td>
</tr>
<tr>
<td>Next shell</td>
<td>“say boo”</td>
<td>“oh”</td>
</tr>
<tr>
<td>Physical cue</td>
<td>“say boo”</td>
<td>“boo”</td>
</tr>
<tr>
<td>Transfer trial</td>
<td>“say boo”</td>
<td>“boo”</td>
</tr>
<tr>
<td>Check (no physical cue)</td>
<td>“say boo”</td>
<td>“boo”</td>
</tr>
</tbody>
</table>

**Intervention Phase III**

The Third Intervention was only put in place if the target words did not meet parity of the adult form during Phase I or Phase II. In this phase, the use of finger spelling was implemented. The trial ran the same as the first intervention except when an error occurred. When an error occurred, the experimenter presented the shell three times with finger spelling. Finger spelling in this intervention is the presenter saying the sound while spelling the letter of the sound using American Sign Language. If the participant responded incorrectly on the three repetitions, the instructor modeled the first shell originally used or the highest-level word shell that was imitated accurately. When the participant vocally matched the word shell, the instructor praised the participant and then moved on to another “easy word”.
**Dependent Variable**

The dependent variable was measured as the number of trials to reach parity of the adult word form. A daily probe listing the three target words and their shells was used to collect data. The adult form of the word was used for the cold probes. If the participant received a correct, they met parity to the adult form. If the participant did not receive a correct on the cold probe, the instructor went to the last shell that was previously a success. Example, the participant does not say “Boo Boo” on the cold probe and the day before the participant could say “buh”. Then the instructor would start with the level “buh” after the cold probe and number four would be circled on the cold probe form. The instructor would then start trials at that level.

**Dependent Variable Inter-observer Agreement (IOA)**

On specifically determined days, inter-observer agreement (IOA) was conducted on the implementation of the cold probes for 50% of all probes in all phases. Inter-observer agreement scores were recorded on the correct data sheets per treatment condition.

**Dependent Variable Scoring**

The number of probes scored the same between observers was the number of correct scores. The correct scores were then divided by the number of incorrect scores plus correct score and then multiplied by 100. The date and IOA score for the session were recorded on the corresponding data collection form. All IOA sessions scored 100%.
Independent Variable Procedural Fidelity

Procedural fidelity was assessed to determine the extent to which the independent variables were implemented as intended. To assess procedural fidelity, sessions were observed by two trained observers to determine the instructor’s compliance with the procedures. A procedural fidelity checklist was used for data collection.

Independent Variable Scoring

A procedural fidelity check was created for all teaching procedures in all three phases. Observers scored their forms simultaneously for each observed treatment condition. Observers one and two compared their scores at the end of the teaching session. A correct score occurred when the answer for a given item was the same for both observers. Correct scores were divided by the number of incorrect scores plus correct scores and then multiplied by 100. This number was the percentage of fidelity for the independent variable. A record of the date and fidelity check score for the session was placed on the corresponding data collection form. Agreement was 100%.

Maintenance

Acquired words were placed in maintenance and reviewed daily as a known or easy word.

Maintenance Cold Probes

Maintenance of cold probes occurred two times per week on random days using the cold probe procedures described.
Chapter 4
Results and Discussion

Trials to Acquisition

The participant acquired two out of the three words in phase three. Each trial equaled five per session. Data for trials within were not collected. Figure 1 shows that boo-boo was not acquired. Neigh-neigh was acquired in thirty-five trials and da da was acquired in fifteen trials. The mean number of trials to acquisition was 25. Figure 2 shows the cumulative word approximations acquired per day.

Figure 1. Number of trials to acquisition

![Graph showing number of trials to acquisition for different words like Boo Boo, Neigh Neigh, and Da Da.](image)
Figure 2. Cumulative word approximations acquired using KWS

The focus of this study was to evaluate the effectiveness of the Kaufman word series program as a method to increase the communication skills of children with autism. The participant was successful in producing the words “neigh-neigh” and “da da” when using the Kaufman word shells. Word one (boo-boo) was dropped because parity was not achieved on day five of phase III so the instructor began Word Two which was neigh neigh. The participant could say “ba” and “oo” but could not bring the sounds together to say “boo”.

Research on shaping new behaviors through operant conditioning has been cited in the literature since 1957 and the Kaufman techniques follow this behavioral shaping method with the end goal of verbal communication. These techniques have been utilized
with systematic methodology since 1989 (The Childhood Apraxia of Speech Association of North America [CASANA], 2010).

Sweeny-Kerwin (2008) said, “The Kaufman method of teaching vocal imitation skills has shown promising results in children with apraxia of speech and therefore deserve experimental investigation” (p. 6). Children with apraxia have difficulty with oral-motor movements to combine the consonants and vowels necessary to form words. Research shows the method of breaking words down into approximations and then shaping the adult form using reinforcement is successful for children with apraxia. This approach encompasses aspects of behavior modification (shaping, cueing, fading) for successful approximations, as well as the knowledge of phonological process, which is the way young children tend to simplify adult forms of words. This process includes the research done by B.F Skinner, Carbone, and Sunburg (Kaufman, 2008). The evidence gained through this study, although modest, contributes to this literature.

Lovaas, Koegel, Simmons and Long (1973) demonstrated that using a shaping procedure to teach vocal imitation produced an increase in vocal procedure to teach vocal imitation in children with developmental disabilities. Similarly, Sloane, Johnston and Harris (1968) found that shaping vocal imitations increased the vocal speech in children diagnosed with autism (Sweeny-Kerwin, 2007).

Vocal language is the primary mode of communication in the world today and is the preferred method of communicating. The main focus of educating children with autism is to prepare them for the adult world. Functional vocal language is not always needed, but helpful in everyday living situations.
Limitations

The results of this study must be viewed through its limitations. First, the participant’s age and unknown history of verbal behavior may have affected the results in some unknown ways. Future researchers may wish to examine the effects of the Kaufman Program across different ages of children. Too, more detailed initial assessment data may be helpful in controlling for history effects. Also, due to the limited time available to conduct the study, additional manipulations of the independent variable could not be made.

Future Research

As demonstrated by this study, further research is needed to examine the use of the Kaufman Word Shells in isolation. In addition, future researchers may want to examine the use of using sign language versus the Kaufman Word Shells to produce intelligible words in students with autism.

Conclusion

The characteristics of autism show that communication in children with autism can be limited or nonexistent. Vocal communication is the most widely used form of communication. The lack of ability to vocally communicate can result in the child not attaining what they need or want and could result in problem behavior. This study has brought educators closer to achieving the goal of teaching functional communication.

The results of the current study conclude that the Kaufman Word Shells did not develop intelligible word production in a student with autism. Using the Kaufman Word Shells with the addition of finger spelling developed intelligible word production for two out of the three words chosen for this study.
Reference


[http://www.baam.emich.edu/baamiscpages/BAAMsevendimensions.htm](http://www.baam.emich.edu/baamiscpages/BAAMsevendimensions.htm)


